1951

A study of the winter food habits of deer in the Rattlesnake Creek drainage

Lowell Otis Asher
The University of Montana

A STUDY
of the
WINTER FOOD HABITS OF DEER
in the
RATTLESNAKE CREEK DRAINAGE

by

Lowell O. Asher

B.S.F., Montana State University, 1948

Presented in partial fulfillment of the requirement for the degree of Master of Forestry.

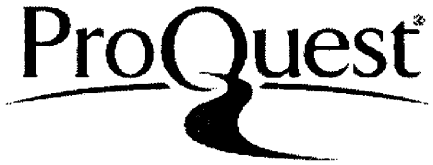
Montana State University

1951

Approved:

Melvin S. Morris
Chairman of Board of Examiners

W. T. Clark
Dean, Graduate School



ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 - 1346

ACKNOWLEDGEMENT

A great deal of thanks is due Mr. Melvin S. Morris, Associate Professor in the School of Forestry, for assisting, in the organization of this study and in the writing of this report.

I wish to express my appreciation to Mr. Kenneth P. Davis, former Dean of the School of Forestry, for his help in organizing the material presented in this paper.

Also, a lot of thanks is extended Mr. Lowell Adams, Regional Biologist, United States Forest Service, for the assistance given in gathering field data.

TABLE OF CONTENTS

LIST OF TABLES

TABLE PAGE

LIST OF FIGURES

A STUDY OF THE WINTER FOOD HABITS OF DEER IN THE RATTLESNAKE CREEK DRAINAGE

INTRODUCTION

Managing large deer populations in the United States under present day conditions is a major and critical problem in some areas. The demand by sportsmen for more game often leads to over utilization of game foods by increased populations. Realization that game numbers must be in balance with range capacity if stable populations are to be maintained, is relatively new to many sportsmen. Although the need for management has been recognized, little has been done to put it into effect until the past fifteen or twenty years. This is due primarily to the fact that so many conservation minded people stress preservation rather than management, and it has been difficult to establish the need for a positive management policy.

The problem of deer management on our western ranges is primarily seasonal. The summer range in many areas has more than an adequate amount of deer food, whereas, winter feed on the same range is greatly limited due to heavy snows and adverse weather. As a consequence, the restricted winter ranges have been over utilized.

This paper reports a study of the winter food habits of Mule Deer (Odocoileus hemionus) over a three months period, January through March, 1949, as observed on an open shrub range in Western Montana. 1/ The amount of use made of forage species is considered indicative of the food habits of the deer in this study. Weight estimates were made on the use of each forage species and later evaluations and comparisons were made to obtain relative food preferences. Reference is made to the palatability tables by Lommasson and De Nio (21) for general comparisons on Western Ranges (Table VII, Appendix).

To obtain the information necessary to make evaluations of the food habits of deer, the following factors are considered essential: (1) The total amount of current annual forage produced, by species; (2) The total amount of current annual forage available, by species; (3) The total amount of current annual forage utilized, by species, during the period readings were made; (4) The percent of utilization of each browse species in the type; (5) Total trends in the utilization of various forage species, under the above conditions of production and availability, over the three month period studied; and (6) The percent of each species in the total diet of deer on the range.

1/ Western Montana is that portion of the state west of the Continental Divide.

REVIEW OF LITERATURE

A great deal of material has been written on the food habits of deer in the United States. It is the purpose of this literature review, however, to present only material relating to studies made in the western states. These references are more related to the local deer situation and will be more pertinent to the study.

DeNio (4) has worked intensively on elk and deer winter feeding habits in the Northern Rocky Mountain Region. He states that the winter food supply is the controlling factor in the big game ranges of Montana and Northern Idaho. Therefore, game population is directly proportional to the quantity and quality of the food supply available during the critical winter periods. Due to deep crusted snow conditions, severe temperatures and strong cold winds, the abundant summer ranges are decreased 82 to 87 percent in the winter. It was found that deer utilized 82 different species in its winter diet, the diet varying according to the weather. Deer consumption of shrubs and conifers reached its highest point in February, with the consumption of conifers making up 71 percent of the diet, and shrubs and conifers by deer was 53 percent and 36 percent respectively. De Nio's forage data includes elk feeding as well as deer feeding. The percentage of utilization

of shrubs showed preferences for elderberry (Sambucus spp.), mountain mahogany (Cercocarpus montanus), buck brush (Ceanothus spp.), willow (Salix spp.), and mountain maple (Acer glabrum) in order mentioned. Western red cedar was the preferred conifer species. It was utilized to 100 percent of its growth capacity. De Nio's forage data is presented in detail in Table VIII in the appendix.

In a report on deer problems on the Kaibab National Forest, E. V. Storm (20) reports that browsing of deer has caused a great deal of damage to young trees of western yellow pine, spruce, fir, juniper, aspen and such browse species as the cliff rose (Cowania mexicana), dwarf ceanothus, snowberry, manzanita, and black sage brush. Overbrowsing has left most of these scraggly and as many branched saplings. It was found that winter deer forage consisted of the following species in order of importance; cliff rose (Cowania mexicana), black sage brush, juniper, and pinion pine.

Ratcliff (17) reports in a range examination in Rocky Mountain National Park and immediately adjacent areas that the vegetation there has steadily declined since 1931. Browse species are being utilized to the point of destruction. Forty to 50 percent utilization of browse is considered as the maximum allowable use, but as much as 75 to 90 percent has been actually utilized. Grasses are not

grazed as heavily as shrubs and in many places are replacing dying browse species. Conifers are being utilized to the extent that a definite browse line can be seen and pine reproduction is being destroyed. He concludes that number reduction of the animals must inevitably be accomplished to save the range.

Aldous (1), in his study of the Nevada Mule Deer, ascertained that prior to 1925, mule deer (Odocoileus hemionus) were noticeably abundant everywhere in the intermountain states and no deer problem areas were apparent on the range. Then regulatory measures were established on the deer ranges; predators were controlled, and buck laws put into effect. The total effect of all of these measures caused an increase in deer populations in favorable localities. These increases occurred so rapidly that few people realized their extent or ultimate effect on the deer and deer ranges.

To determine available utilization percentages, measurement plots were established for each important native browse species on representative sites over the study unit. Samplings were taken from curl leaf mahogany (Cercocarpus ledifolia), bitterbrush (Purshia tridentata) and cliff rose (Cowania slansbureana). Calculations from the total measurements of these plots showed that bitterbrush was utilized 51 percent, cliff rose 38 percent, and mahog-

any 100 percent.

In a study conducted by Edwards (7) on the Malheur National Forest, Oregon, the following plants were found to be preference plants in order of importance; Bitterbrush (Purshia tridentata), curleaf mountain-mahogany (Cercocarpus ledifolius), Sierra juniper (Juniperous Occidentalis), rabbitbrush (Chrypsothanums nauseosus), big sagebrush (Artemisia tridentata), and snowbrush (Ceanothus velutinus). Bitterbrush and the mountain-mahogany are primary food plants on the range, but also furnish important cover for the area. Forty species of plants were found to furnish some winter food for deer, but the above six species furnish 90 percent of the feed on the area. The other 34 species were frequently found to be of great importance in areas where other foods were scarce. In these areas they probably formed the bulk of the diet, however, in Edward's consideration of the entire range, they were found to be incidental.

Hill and Harris (9) in a study of the food preferences of Mule Deer and Whitetail Deer in the Black Hills found that the principal food plants on the winter range were; bearberry (Arctostaphylos uva-ursi), buckbrush (Symphoricarpus occidentalis), ponderosa pine (Pinus ponderosa), Oregon grape (Odosteman repens), rose (Rosa spp.), serviceberry (Amelanchier alnifolia), weeds, grass and wheat.

Stomach analysis studies were made giving factual information as shown in Table IX in the appendix.

There is a definite lack of information showing actual productivity of forage species. Most evaluations of food habits are qualitative and so limited in actual information that it is impossible to establish food supply, use and diet on a game range.

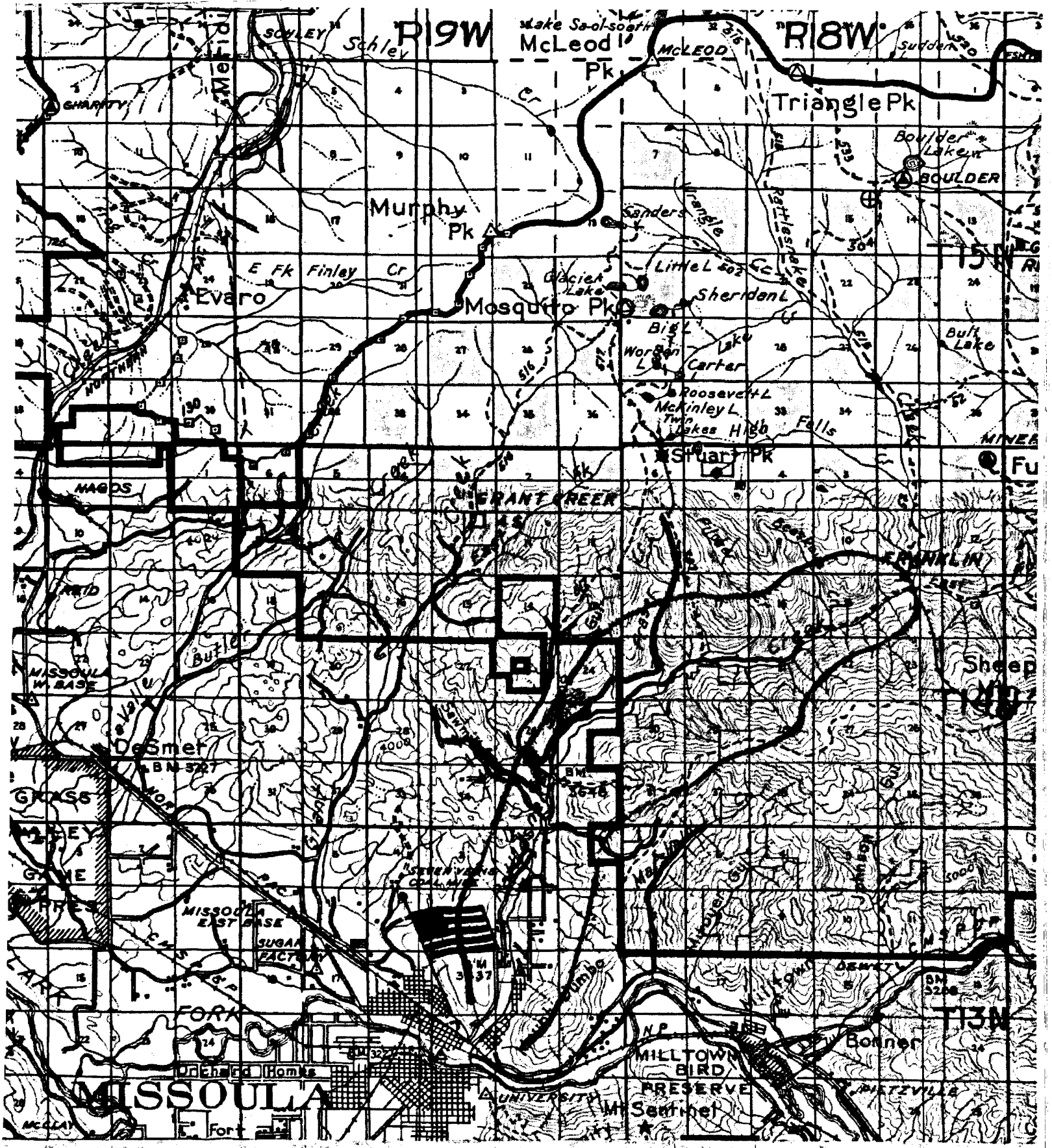


Figure I

Map of the Rattlesnake Creek drainage

Green - Approximate boundries of the drainage

Purple - Boundries of brush type studied

Red - Sample Area

Scale $\frac{1}{2}$ inch = 1 mile

METHODS

Area Studied

The range chosen for study is located in the Rattlesnake Creek Drainage about seven miles northeast of Missoula, Montana (Figure 1). The lower portion of the drainage was burned over by forest fires in 1910 and 1918. Due to these fires, the area is primarily covered by low browse species and grasses. There are a few scattered trees on the area, namely ponderosa pine and Douglas fir.

A sample area with a southeasterly exposed slope, approximately 62 acres in size was selected for detailed study. Eighteen mule deer (Odocoileus hemionus) were seen in February browsing the area chosen, indicating that deer use the area in their winter feeding. The animals were seen only once more during the study; however, fresh tracks and signs were seen each time measurements were made. Deer was the only big game animal seen on the area all winter. Use by other game animals has been of little significance on this area, according to the Montana Fish and Game Department.

Determination of the Number and the Location of the Plots On the Area

A preliminary sampling was made of the study area and statistical formulae were applied to the data to determine the number of plots necessary to sample the area to give a

mean within 10 percent of the true value for the study area as a whole. It was found that there was so much variation in the amount of each species utilized on the various plots that the statistically computed number of plots was too large to apply to this study. After due consideration of sampling methods, the sample area and time involved in taking readings, it was decided that forty-five plots, ten feet by ten feet, would give a sufficient sampling which could be readily handled.

To get a pattern for sampling, three lines, each fifteen hundred feet long (Figure 2) were run from the base of the slope to the top of the slope. Each line was offset four hundred and fifty feet from the other. The forty-five plots were located every one hundred feet on the lines, with the lower right hand corner of the plot being on the one hundred foot point on the line.

Measuring Forage Production and Utilization

Before discussing methods used in this study for measuring forage, the meaning of forage production, forage availability and forage utilization will be defined. Forage production is the total current annual growth produced by a plant. Forage availability is that amount of the current growth which is available to the animal, excluding all production out of reach of the animal and portions of the plants inaccessible, due to snow. Height limitations were established at six feet in this study. For-

Figure II

Aerial view of the lower portion of the Rattlesnake Creek Drainage (Showing sample area and the relative location of each line of plots on the area).

(Scale = 1/20,000)

age utilization is the degree to which animals have consumed the total annual available production of a plant. Forage production, forage availability and forage utilization must ultimately be expressed in terms of some unit area.

There are a number of ways to measure range production, availability and utilization. They are; volume estimates, height or length measurements, weight estimates and density measurements.

The weight list method as designed by Pechanec and Pickford (16) was used in this study. They pointed out that the weight list system is the most accurate and probably the most rapid for measuring forage. The method consists of clipping current annual growth to get forage production. The field technique which they consider most advantageous in weight estimation and is used in this study, is to clip a plot or a portion of a plot immediately upon entering a new type. From this the examiner gains an overall concept of the weight of plants of each species in the type and he is then able to make comparisons in weight with plants on the sample plots upon which cuttings cannot be made. As the examiner progresses through the type, he revises his estimates by the appearance of the forage. Clipping checks should be made approximately every fifth plot in using this method.

Using the weight list method, outlined above, the amount of current annual forage produced, the amount of current annual forage available, and the amount of current annual forage utilized by deer were estimated in grams.

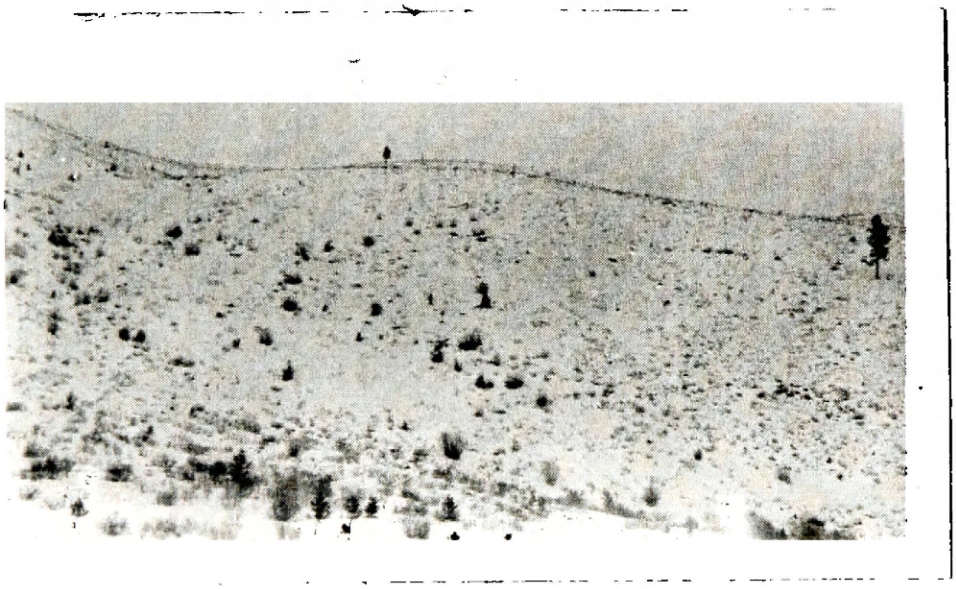


Figure III

General view of the study area. Sample plots were run in rows up and down the slope. Taken in February, 1949.

The grams were later converted into pounds per acre. Check clippings were made where there was a decided change in vegetation. These clippings were made by removing the current annual growth from a typical bush of each species and weighing it with a gram scale. Comparison estimation was then made on the study plots using the clippings as the basis for the comparisons.

The height of plants was not a significant factor in

availability as most of the plants on the area were fairly small. Snow depth, however, had a very definate effect on the availability of the plants. A large percentage of the plants were buried by the heavy snows and were inacces-

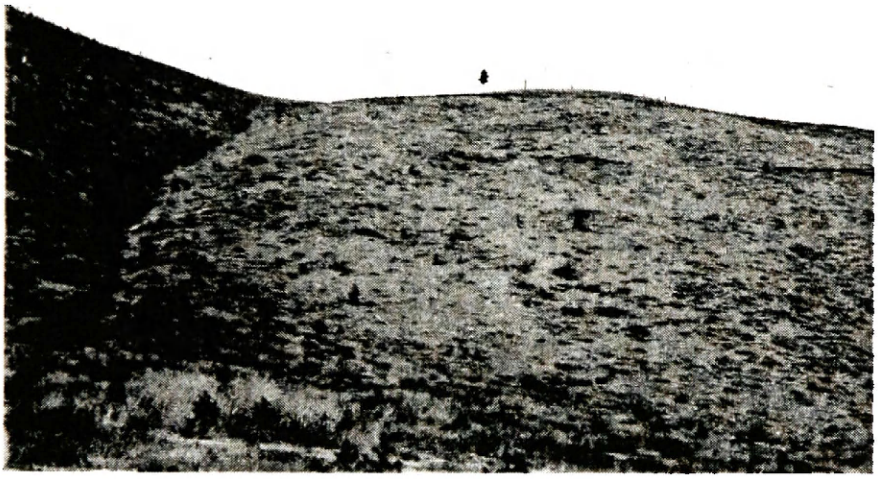


Figure IV

View of the study area, taken April 1, 1949.

sible to the animals. Relative snow depth on the area during the study is given in Table I.

Field observations were made on the first of the month, beginning the first of February. The readings represent winter browsing from the first browsing on the area in the fall to the date the observation was made.

The sample area was of one type and one exposure,

therefore, site and exposure comparisons cannot be made in this study.

RESULTS

The data obtained in this study are limited in quantity, but will serve as a basis for further studies on food habits of deer in Western Montana. The sample area was set up in January and consequently, November and December readings were not obtained. Had readings been available for November and December, more definite results could have been given of the trends in the deer food habits.

Probably the greatest handicap to the study was caused by the adverse weather conditions. The winter was severe, with temperatures and snow depths established as new extremes for Western Montana (Table I). This condition hampered sampling a great deal, as well as inhibiting the deer in their movements on the range. Browsing on the area was confined to localized areas, along definite game trails, and on areas where the wind could get a full sweep and blow the snow clear of the plants. The snow depth on the area varied from twelve to thirty-six inches during the months of January and February. When March readings were taken, the area was free of snow. The figures derived from the January and February measurements are used as monthly comparisons of food habits and the March figures represent an over-all picture of the seasonal use.

The available shrub species represented on the site are listed in Table X in the appendix. Of this list, only

Table I

WEATHER DATA FOR MISSOULA AND VICINITY SHOWING CURRENT YEAR SNOW DEPTHS AND COMPARISONS OF THE 1949 MEAN TEMPERATURES WITH MEAN TEMPERATURES OVER THE PAST 56 YEARS 1/

Month	Mean temperature Over Past 56 Years (degrees in F)	Mean Temperature for 1949 (degrees in F)	Degrees 2/ off Normal (degrees in F)	Average Current Snow Depth 3/ (inches)
January	22.4	4.5	14.1	19.4
February	27.1	21.4	2.4	19.0
March	35.9	31.7	1.8	8.0

1/ Weather data obtained from the Missoula Weather Bureau.

2/ Figures are all below the normal established by the Weather Bureau.

3/ Measurements were taken on sample plots several times during the period of study.

a few of the species are of importance in the food habits of the deer on the area. Results of the study are contained in Tables II through VI. Tables II and III contain browsing data for January and February respectively. Table IV gives a summary of seasonal browsing. Table V is a graphic representation of availability and utilization. Summarization of all the tables is found in Table VI.

Total current annual browse production was measured in March, as heavy snows covered the area when the study was begun and it was impossible to obtain the total production figure. It is realized that this figure is more of an estimation than it would have been if the production on the plots had been measured in the fall before browsing. Production is estimated on the basis of what was left and the amount browsed. The total production for the area was found to be 87 pounds per acre; however, deep snows reduced this figure to 12 and 20 pounds of available browse per acre in January and February, respectively. In January only 4 pounds of this available amount of forage was utilized in the diets of deer. In February 5 pounds of available forage was utilized, the increase was probably due to a greater restriction of range for the deer and consequently, heavier use on the plants available. In March, (readings taken April 1), less snow covered the area, exposing 76 pounds of available browse per acre. Of

this, only 11 pounds per acre was utilized. Browse was being utilized on plots which had not been touched during January and February. The January reading not only contains the use in January but the use which may have occured during the fall. However, from general knowledge of Mule Deer movement, it is believed that they would occupy a much higher range in the summer and fall and would be out of the area from October 15 through November 15 because of hunting pressure. April 1, utilization figures showed an increase of 6 pounds per acre over March 1, figures.

Three browse species made up the diet of the deer in January and February. Chokecherry (Prunus melanocarpa) was the preferred species on the area during both months. It was overutilized to the point where more than the current annual growth was taken. Had this species been more prevalent, utilization of this species would have been increased in the diets of the deer. The overutilization has been accumulating over a number of years, in that many plants of the species are dead or dying from apparent clipping. Especially is this noticeable on the northwest corner of the sample area, near the top of the ridge. Sampling showed 50 percent of the current available production of Chokecherry being utilized in January and 60 percent utilized in February. The other two species found in the diet in January and February are serviceberry (Amelanchier alnifolia) and snowbrush (Ceanothus velutinus). Both of these

Table II

AVAILABILITY AND UTILIZATION OF DEER BROWSE

IN THE RATTLESNAKE CREEK STUDY AREA

AS OBSERVED FEBRUARY 1, 1949

Common Name	Scientific Name	Total Browse 1/ Production Pounds per acre	Browse Availability Pounds per Acre	Browse Utilization Pounds per Acre	Use 2/ Percent	Total 3/ Diet Percent
Chokecherry	Prunus melanocarpa	13	4	2	50	50
Serviceberry	Amelanchier alnifolia	9	2	1	50	25
Snowbrush	Ceanothus velutinus	44 4/	2 4/	1 4/	50 4/	25 4/
Wild Rose	Rosa spp.	1	1	--	--	--
Ninebark	Physocarpus malvaceous	11	1	--	--	--
Snowberry	Symphoricarpus albus	3	2	--	--	--
Creeping hollygrape	Berberis repens	4	0	--	--	--
Bearberry	Arctostaphylos uva-ursi	2	0	--	--	--
Totals		87	12	4		100

1/ Obtained after the snow melted off the area in March.

2/ Percent Use of Each Species = $\frac{\text{Total Utilized Weight of the Species}}{\text{Total Available Production Weight of the Species}}$

3/ Percent of each Browse Species in Total Diet = $\frac{\text{Total Utilized Weight of Each Species}}{\text{Total Utilized Weight of all Species}}$

4/ Includes leaves which are not utilized.

Table III

AVAILABILITY AND UTILIZATION OF DEER BROWSE

IN THE RATTLESNAKE CREEK STUDY AREA

AS OBSERVED MARCH 1, 1949

Comman Name	Scientific Name	Total Browse 1/ Production Pounds per acre	Browse Availability Pounds per Acre	Browse Utilization Pounds per Acre	Use 2/ Percent	Total 3/ Diet Percent
Chokecherry	Prunus melanocarpa	13	5	3	60	60
Snowbrush	Ceanothus velutinus	44 4/	5 4/	1 4/	20 4/	20 4/
Serviceberry	Amelanchier alnifolia	9	4	1	25	20
Wild Rose	Rosa spp.	1	1	--	--	--
Ninebark	Physocarpus malvaceous	11	4	--	--	--
Snowberry	Symphoricarpus albus	3	1	--	--	--
Creeping hollygrape	Berberis repens	4	--	--	--	--
Bearberry	Arctostaphylos uva-ursi	2	--	--	--	--
Totals		87	20	5		100

1/ Obtained after the snow melted off the area in March.

2/ Percent Use of Each Species = $\frac{\text{Total Utilized Weight of the Browse Species}}{\text{Total Available Production Weight of the Species}}$

3/ Percent of Each Browse Species in Total Diet = $\frac{\text{Total Utilized Weight of Each Species}}{\text{Total Utilized Weight of all Species}}$

4/ Includes leaves which are not utilized.

Table IV

SEASONAL BROWSE PRODUCTION,

AVAILABILITY AND UTILIZATION OF DEER BROWSE

IN THE RATTLESNAKE CREEK AREA

AS OBSERVED APRIL 1, 1949

Comman Name	Scientific Name	Total Browse 1/ Production Pounds per Acre	Browse Availability Pounds per Acre	Browse Utilization Pounds per Acre	Use 2/ Percent	Total 3/ Diet Percent
Chokecherry	Prunus melanocarpa	13	9	4	44	36
Serviceberry	Amelanchier alnifolia	9	7	1	14	9
Snowbrush	Ceanothus velutinus	44 4/	39 4/	5 4/	13 4/	45 4/
Wild Rose	Rosa spp.	1	1	1	100	9
Ninebark	Physocarpus malvaceous	11	11	--	--	--
Snowberry	Symphoricarpus albus	3	3	--	--	--
Creeping hollygrape	Berberis repens	4	4	--	--	--
Bearberry	Arctostaphylos uva-ursi	2	2	--	--	--
Totals		87	76	11		100

1/ Obtained after the snow went off the area this month.

2/ Percent use of each species = $\frac{\text{Total Utilized Weight of the Browse Species}}{\text{Total Available Production Weight of the Species}}$

3/ Percent of each Browse Species in Total Diet = $\frac{\text{Total Utilized Weight of Each Species}}{\text{Total Utilized Weight of all Species}}$

4/ Includes leaves which are not utilized.

species were smaller plants than the chokecherry and were fairly well covered by snow during the month of January and browsing of them was greatly limited during this period. This was true to a much greater degree for snowbrush

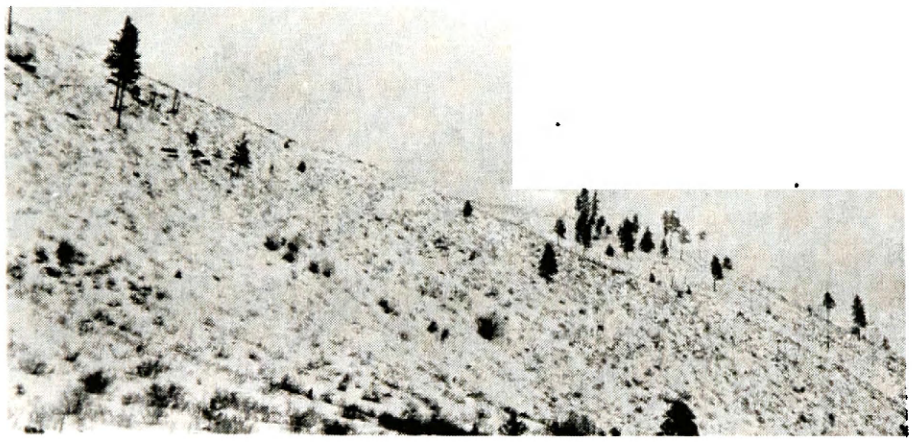


Figure V

A portion of the sample area in February. This section of the range was heavily used by deer.

than serviceberry, since snowbrush is the smaller plant. Observations show a decided shift in preference for serviceberry in January to snowbrush in February. February winds blew the snow clear of some of the snowbrush plants, increasing their availability. Also, to be taken into consideration is the method of sampling snowbrush plants. Deer removed both stems and leaves from these plants. However, it was apparent that only stems were utilized to any extent

by the deer. Leaves in most cases were stripped off the stems and left on the ground. Since both leaves and stems were removed from the plant, both were included in the weight estimation. It is apparent then that weights given the plant may not indicate exact consumption of the species.

In records taken April 1, representing the accumulative use through March, four browse species were represented in the total diet of the deer. Snowbrush replaced chokecherry as the preferred species. As mentioned above, the figures for snowbrush are not entirely correct, because of the difficulty in determining the amount of snowbrush consumed. Although snowbrush represents 45 percent of the diet and chokecherry 36 percent, it seemed to be more correct to rate the chokecherry as the preferred food. Serviceberry ranks third in preference, representing 9 percent of the diet, with wild rose which was limited in supply, rating fourth. Rose was heavily utilized but made up a relatively small amount of the total available forage.

Comparisons of total availability and total utilization can be seen in Table V. The table includes species not utilized as well as those utilized.

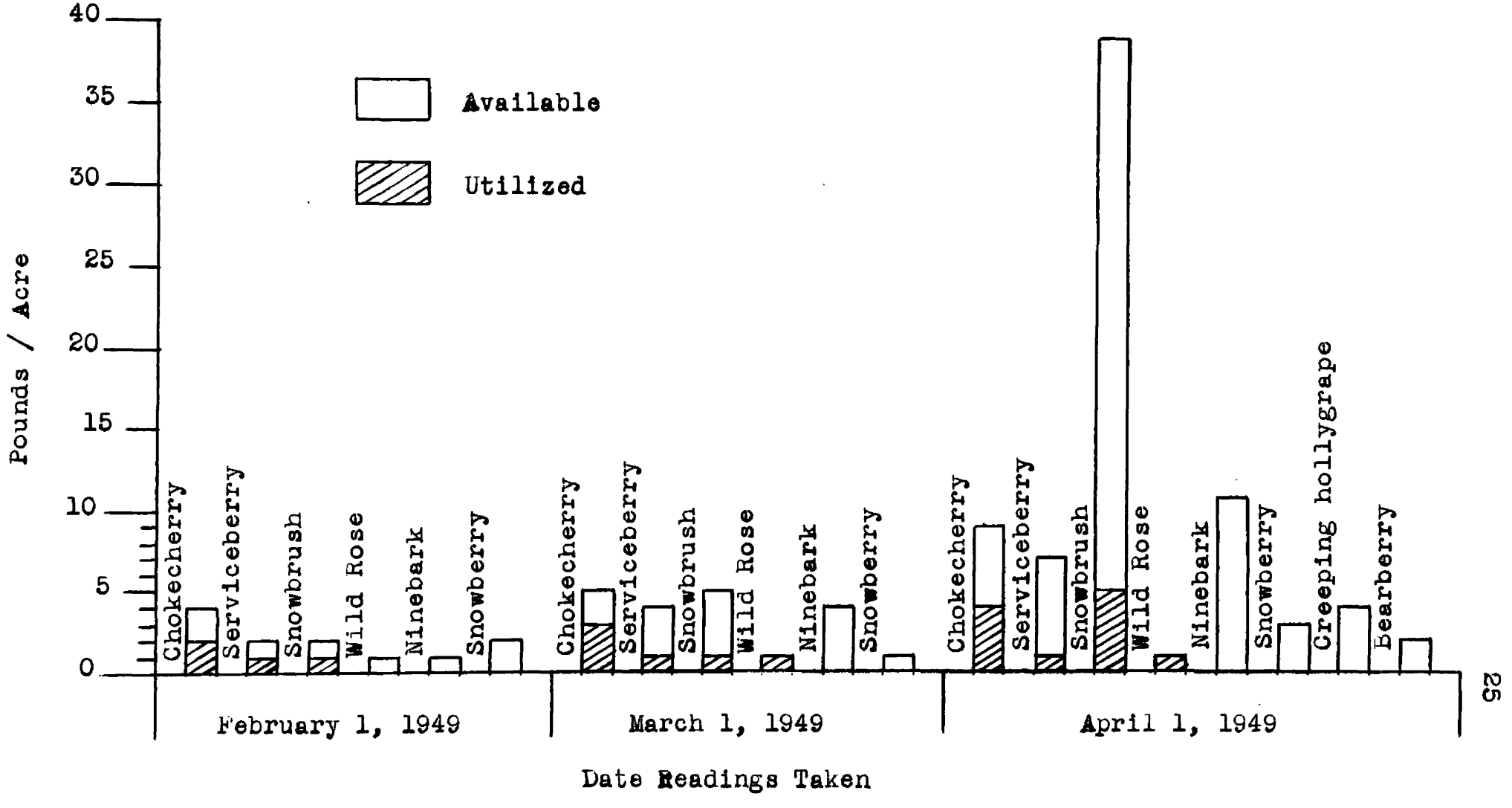
Two other species of importance as food were yellow willow (Salix spp.) and the mountain maple (Acer glabrum). These were widely scattered over the area and none were included in the sample plots. It was found in sampling

Table V

COMPARISON BETWEEN TOTAL AVAILABILITY AND TOTAL UTILIZATION

OF EACH SPECIES ON THE RATTLESNAKE CREEK STUDY AREA

FOR JANUARY, FEBRUARY AND MARCH, 1949



these species, that the deer had browsed them fairly heavily; however, as they weren't of significant amounts they were excluded in figuring Total Diet Percentages. One sampling of each species in March indicated the following use:

Species	Amount Available (Grams)	Amount Used (Grams)	Use (Percent)
Willow	156	80	51
Mountain maple	143	27	19

Figure VI

A close-up view taken in February showing in more detail the availability of the forage.

Conifers on the area were widely scattered and were left untouched by the deer.

Many more species were apparent on the plots during this examination that were of no apparent importance in

the deer diets. To mention some of these; ninebark (Physocarpus malvaceous), snowberry (Symphocarpus albus), creeping holly grape (Berberis repens) and bearberry (Arctostaphylos uva-ursi).

A summary of Tables II, III, and IV is found in Table VI. Using this table, closer comparisons can be made on the results of the study.

Table VI

A SUMMARY OF PRODUCTION, AVAILABILITY AND UTILIZATION

FROM TABLES II, III, and IV

Species Browsed	Production Pounds per Acre	Observation Made: February 1, 1949 Total[1] Available (Percent)	Use[2] (Percent)	Diet[3] (Percent)	March 1, 1949 Total[1] Available (Percent)	Use[2] (Percent)	Diet[3] (Percent)	April 1, 1949 Total[1] Available (Percent)	Use[2] (Percent)	Diet[3] (Percent)
Chokecherry	13	34	50	50	26	60	60	12	44	36
Serviceberry	9	17	50	25	19	25	20	10	14	9
Snowbrush	44 [4]	17 [4]	50 [4]	25 [4]	27 [4]	20 [4]	20 [4]	51 [4]	13 [4]	45 [4]
Wild Rose	1	1	--	--	3	--	--	2	100	9
Ninebark	11	11	--	--	19	--	--	15	--	--
Snowberry	3	19	--	--	7	--	--	4	--	--
Creeping hollygrape	4	--	--	--	--	--	--	6	--	--
Bearberry	2	--	--	--	--	--	--	2	--	--
Totals	87	99		100	100		100	100		100

1/ Percent of Total Available = $\frac{\text{Weight of each Browse Species Available}}{\text{Total Weight of all Browse Species Available}}$
(Includes species not taken in Deer diets)

2/ Percent Use of Each Species = $\frac{\text{Total Utilized Weight of the Browse Species}}{\text{Total Available Production Weight of the Species}}$

3/ Percent of Each Browse Species in Diet = $\frac{\text{Total Utilized Weight of the Browse Species}}{\text{Total Utilized Weight of all Browse}}$

4/ Includes stems and leaves of the plant.

SUMMARY

Utilization by deer of browse in the winter was studied on a representative area in the Rattlesnake Creek drainage about seven miles north of Missoula, Montana. Forty-five plots, each ten feet square, were located on the area by systematic methods of selection.

The study was conducted during the months of January, February and March; observations being made once each month. The weather conditions during these months were below the mean for the past fifty-six years and the snow lay 3 feet deep on the area during most of the study. (Refer to Table I) Due to these adverse conditions, the deer were restricted in their forage.

Forage available and forage utilized was determined by the weight estimate method. The field technique used in this study was to clip the annual growth from samples of each species on the area. From this it was possible to gain an overall concept of the weight of the species. With this information, forage weight estimates were made on the plants in the plots on which clippings could not be made. Clipping was repeated to check estimates as browse varied in form and density.

Total browse production on the area was found to be 87 pounds per acre. A breakdown of this figure by species

shows snowbrush (Ceanothus velutinus) as the largest producer of forage. 2/ Other species contributing to composition in order of importance are; chokecherry (Prunus melanocarpa), ninebark (Physocarpus malvaceous), serviceberry (Amelanchier alnifolia), creeping hollygrape (Berberis repens), snowberry (Symphoricarpos albus), bearberry (Arctostaphylus uva-ursi) and wild rose (Rosa spp.), (Table VI)

In January (Table II), chokecherry was the most available species on the area, the remainder listed according to availability are: snowberry; serviceberry; snowbrush; ninebark; and wild rose. Three species were utilized as food on the area. They were, according to importance: chokecherry; serviceberry; and snowbrush. Chokecherry made up 50 percent of the total diet, serviceberry 25 percent, and snowbrush 25 percent. Fifty percent of the available chokecherry browse was utilized, 50 percent of the serviceberry and 50 percent of the snowbrush.

February observations, (Table III), showed snowbrush as the most available browse, and chokecherry second. Others listed, according to importance are: serviceberry; ninebark; snowberry; and wild rose.

Chokecherry, snowbrush and serviceberry are listed

2/ Sampling of snowbrush includes leaves which are not entirely utilized by deer.

according to use, as the browse species utilized on the area during February. Chokecherry made up 60 percent of the diet; snowbrush and serviceberry each represented 20 percent of the diet. Sixty percent of the chokecherry on the area was utilized, 25 percent of the serviceberry, and 20 percent of the snowbrush.

Figure VII

A view taken in May of that portion of the range heavily used by deer.

March observations (Table IV) were used as seasonal browse figures. Snowbrush was the most available species on the area. The rest are listed according to availability; ninebark; chokecherry; serviceberry; creeping hollygrape; snowberry and wild rose.

Four browse species utilized, according to import-

ance were: snowbrush; chokecherry; serviceberry; and wild rose.

Snowbrush made up 45 percent of the diet; chokecherry 36 percent; serviceberry 9 percent and wild rose 9 percent.

Forty-four percent of the chokecherry available was utilized, 14 percent of the serviceberry, 13 percent of the snowbrush, and 100 percent of the wild rose.

A summary of the percentages of availability, use and total diet is found in Table VI giving a clearer presentation for comparisons.

CONCLUSION

The study though limited in sphere, has brought out certain significant facts upon which judgements can be made. The following are made:

1. The weight estimate method is a relatively simple procedure. However, great care must be taken in making weight estimate comparisons.

2. Chokecherry (Prunus melanocarpa) was found to be the most preferred species on the range. It has been over-used on the area for a number of years, being killed due to overuse in some instances. Other browse species which were preferred by deer on the study area are, snowbrush (Ceanothus velutinus), serviceberry (Amelanchier alnifolia), wild rose (Rosa spp.).

3. Problem of snow depth and weather conditions contribute to varying the availability and period change in use of various forage species.

4. Of the numerous shrubs present the number of species contributing to diet is somewhat limited. Ninebark (Physocarpus malvaceous), creeping hollygrape (Berberis repens), and bearberry (Arctostaphylos uva-ursi) are a few of the species which were prevalent but of no forage value.

BIBLIOGRAPHY

1. Aldous, C. M.
   1945. "A Winter Study of Mule Deer in Nevada", Jour. Wildl. Mgt., April 9, No. 2.

2. Canfield, R. H.
   1941. "Application of the Line Interception Method in Sampling Range Vegetation", Jour. For., April.

3. Deen, J. T.
   1938. "Methods of Studying Browse Preferences of Deer", Trans. 3rd N. A. Wildl. Conf.

4. De Nio, R. M.
   1938. "Elk and Deer Foods and Feeding Habits", Trans. 3rd N. A. Wildl. Conf.

5. Dixon, Joseph
   1934. "A Study of the Life History and Food Habits of Mule Deer in California", California Fish and Game, No's 3 and 4.

6. Doman, E. R., and Rasmussen, D. I.
   1944. "Supplemental Winter Feeding of Mule Deer in Northern Utah", Journ. Wildl. Mgt., 8(4).

7. Edwards, Oliver T.
   1942. "Survey of Winter Deer Range, Malheur National Forest, Oregon", Jour. Wildl. Mgt., 6(3), 1942.

8. Grimm, Rudolph
   1939. "North Yellowstone Winter Range Studies", Jour. Wildl. Mgt., 3(4), 1939.

9. Hill, Ralph R. and Harris, Dave
   1943. "Food Preferences of Black Hill Deer", Jour. Wildl. Mgt., 7(2), 1943.

10. Hormay, A. L.
    1949. "Getting Better Records of Vegetation", Professional Paper, California Experimental Station.

11. Interagency Range Survey Committee
1947. "Instructions For Range Surveys", Interagency Range Survey Conf., April 24, 1937, Washington, D. C.

12. Leopold, Aldo; Sowls, Lyle; and Spencer, David
1947. "A Survey of Over-populated Deer Ranges in the United States", Jour. Wildl. Mgt., 2(2).

13. McElfresh, D., and Russiff, J.
1948. "Winter Forage Preference of Elk in the Cap Wallace Area", Lubrecht Experimental Forest.

14. Mitchell, G. E.
1944. "The Murderer's Creek Deer Herd", Trans. 9th N. A. Wildl. Conf.

15. Murie, Olaus J.
1944. "Our Big Game in Winter", Trans. 9th N. A. Wildl. Conf.

16. Pechanec, J. F., and Pickford, G. D.
1937. "A Weight Estimate for the Determination of Range or Pasture Production", Jour. Am. Soc. Agronomy, 29(11).

17. Ratcliff, Harold
1941. "Winter Range Conditions in Rocky Mountain National Park", Trans. 6th N. A. Wildl. Conf.

18. Schwas, H. E. and Swift, Lloyd
1941. "Forage Inventory Methods, with Special Reference to Big Game Ranges", Trans. 6th N. A. Wildl. Conf.

19. Stoddard, Lawerence A., and Smith, Arthur D.
1934. Range Management, McGraw-Hill Book Co., Inc., New York and London.

20. Storm, E. V.
1920. "Deer Problems on the Kaibab National Forest", Professional Paper.

21. West, Raymond M.
1941. "Elk of the Northern Rocky Mountain Region", Field Notes on Wildlife Northern Rocky Mountain Region, August 1, Vol. II, No. 9.

APPENDIX

COMPARATIVE VALUE OF SHRUBS IN THE DIET OF ELK

AND DEER DURING THE WINTER SEASON IN WESTERN MONTANA. 1/

Shrub Species		Average Palatability Rating		
Scientific Name	Comman Name	W.T. Deer	Mule Deer	Elk
Acer glabrum	Mountain maple	good	good	fair
Alnus tenuifolia	Alder	poor	poor	poor
Amelanchier alnifolia	Serviceberry	good	good	good
Apocynum androgemaefolium	Dogbane	none	none	x
Arctostaphylos uva-ursi	Kinnikinnick	poor	poor	poor
Artemisia cana	Silver sage	--	--	--
Artemisia discolor	Green sage	--	--	--
Artemisia frigida	Silver sage	--	--	--
Artemisia tridentata	Big sage	fair	fair	poor
Betula fontinalis	Red birch	poor	poor	good
Betula glandulosa	Resin birch	poor	poor	fair
Ceanothus sanquinous	Small leaf ceanothus	excel.	excel.	excel.
Ceanothus velutinus	Snowbush	excel.	excel.	v.g.
Cercocarpus ledifolia	Curled leaf mahogany	fair	fair	*
Cercocarpus montanus	Mountain mahogany	--	--	--
Chimanthila umbellata	Pipsissewa	poor	poor	poor
Chrysothamnus lanceolatus	Lance leaf rabbit brush	--	--	--
Chrysothamnus oreophilus	Rabbit brush	good	good	good
Chrysothamnus sp.	Rabbit brush	good	good	good
Clematis columbiana	Clematis	--	--	--
Cornus stolonifera	Dogwood	fair	fair	good
Crataegus douglasii	Black hawthorn	--	--	--
Crataegus sheridana	Hawthorn	v.p.	v.p.	poor
Dasiophora fruticosa	Shrubby cinquefoil	*	*	poor
Elaeagnus commutata	Silverberry	--	--	--
Eurotia lanata	Winter fat	--	--	--
Fraxinus lanceolata	Green ash	*	*	good

(continued)

1/ Excerpt from Table I, in Field Notes on Wildlife, "Elk of the Northern Rocky Mountain Region", by Raymond M. West.

COMPARATIVE VALUE OF SHRUBS IN THE DIET OF ELK

AND DEER DURING THE WINTER SEASON IN WESTERN MONTANA.

Shrub Species		Average Palatability Rating		
Scientific Name	Comman Name	W.T. Deer	Mule Deer	Elk
Grossularia sp.	Gooseberry	*	*	poor
Ledum glandulosum	Labrador tea	--	--	--

* Forage species reported as occuring on the winter range but no use by game observed.

-- No occurance on winter range.

x No studies made on palatabilities for these species due to lack of elk on range from which species were reported.

Table VIII

FORAGE DATA OF NORTH STAR CREEK STUDY AREA IN IDAHO

PALATABILITY, AVAILABILITY AND UTILIZATION TABLE

AS TAKEN FROM DE NIO'S PUBLICATION 1/

SHRUBS

Scientific Name	Comman Name	Per Cent Utilization
Acer glabrum	Mountain maple	40
Amelanchier	Serviceberry	50
Arctostophylos uva-ursi	Kinnikinnick	60
Ceanothus sanguineus	Buckbrush	80
Ceanothus velutinus	Buckbrush	80
Cercocarpus montanus	Mtn. mahogany	30
Chimaphila umbellata	Pipsissewa	30
Cornus spp.	Dogwood	50
Linnaea borealia	Twin flower	45
Odostemon acquifolium	Oregon grape	65
Opulaster malvaceus	Ninebark	10
Philadelphus lewisee	Mock orange	5
Prunus spp.	Wild cherry	15
Rhamnus purshiana	Cascara buckthorn	15
Rosa spp.	Rose	5
Ruba parviflorus	Thimbleberry	10
Salix spp.	Willow	80
Sambucus spp.	Elderberry	80
Sericotheca discolor	Ocean spray	5
Symphoricarpos spp.	Snowberry	5

1/ De Nio, R. M., 1938, "Elk and Deer Foods and Feeding Habits of Mule Deer in California", California Fish and Game, No's 3 and 4.

Figure VIII

FORM FOR RECORDING FIELD DATA

Date_____ Sheet No._____

Plot No	Species	Annual Production	Amount Forage Available	Amount Forage Utilized	Snow Depth

TABLE IX

STOMACH CONTENTS OF 99 BLACK HILLS DEER

(PERCENTAGES)

Plant Species	Whitetail Deer						Mule Deer	
	Jan.-Apr.		May-Sept.		Oct.-Dec.		Oct.-Dec.	
	17 Deer		8 Deer		54 Deer		20 Deer	
	Frequency a/	Volume b/	Frequency	Volume	Frequency	Volume	Frequency	Volume
Bearberry (Arctostaphylos uva-ursi)	71	23.8	--	--	76	15.3	85	11.2
Ponderosa Pine (green) Pinus ponderosa	59	11.1	25	0.1	15	1.8	10	0.5
Buck brush (Symphoricarpus occidentalis	59	10.1	62	1.8	50	9.9	45	10.0
Oregon grape (Odostemon repens)	41	6.7	25	0.4	69	15.0	80	29.4
Wild rose (Rosa)	47	6.2	100	22.2	46	2.6	55	2.8
Serviceberry (Amelanchier)	59	5.6	50	2.9	41	1.9	40	1.0
Snowbrush (Ceanothus velutinus)	6	2.6	12	tr.	28	4.0	40	6.7
Bur oak (Quercus macrocarpa)	53	2.5	--	--	9	0.3	5	1.3
Aspen (Populus tremuloidus)	12	1.8	62	21.0	30	0.3	30	0.4
Creeping juniper (Juniperus horizontalis)	18	1.5	--	--	--	--	--	--
Willow (Salix)	24	1.3	--	--	13	0.6	10	3.2
Ground juniper (Juniperus communis)	18	0.9	12	tr.	33	4.5	55	8.5
Paper birch (Betula papyrifera)	12	0.9	--	--	--	--	--	--
Hawthorn (Crataegus)	6	0.1	--	--	--	--	--	--
Fringed sage (Artemisia frigida)	12	0.1	--	--	2	0.1	--	--
Ponderosa pine (dry) Pinus ponderosa	53	0.1	62	0.4	48	0.4	60	0.3
White spruce (Picea glauca albertiana)	6	0.1	12	tr.	15	0.1	--	--
Twinflower (Linnaea americana)	--	--	12	tr.	20	3.2	25	0.6
False tarragon (Artemisia dracunculoides)	--	--	--	--	4	0.6	--	--
Rocky Mountain sumac (Rhus cismontana)	6	tr.	--	--	4	0.2	5	tr.
Grouse whortleberry (Vaccinium scoparium)	--	--	--	--	2	0.2	5	tr.
Snowberry (Symphoricarpos albus)	--	--	--	--	4	0.1	--	--
Meadowsweet (Spiraea lucida)	--	--	--	--	2	tr.	--	--
Green ash (Fraxinus lanceolata)	--	--	--	--	2	tr.	5	tr.
Red willow (Cornus baileyi)	--	--	12	3.1	4	tr.	--	--
Honeysuckle (Lonicera glaucescens)	--	--	--	--	2	tr.	--	--
Chokecherry (Prunus melanocarpa)	6	tr.	25	tr.	--	--	--	--

(continued)

TABLE IX

STOMACH CONTENTS OF 99 BLACK HILLS DEER

(PERCENTAGES)

Plant Species	Whitetail Deer						Mule Deer	
	Jan.-Apr.		May-Sept.		Oct.-Dec.		Oct.-Dec.	
	17 Deer		8Deer		54 Deer		20 Deer	
	Frequency a/	Volume b/	Frequency	Volume	Frequency	Volume	Frequency	Volume
Ironwood (Ostrya virginiana)	6	tr.	--	--	--	--	--	--
Beaked hazel (Corylus rostrata)	6	tr.	12	0.2	--	--	--	--
Squabrush (Ceanothus mollissumus)	--	--	12	1.2	--	--	--	--
Unidentified browse	--	--	25	1.8	--	--	--	--
Total Browse		75.4		55.6		61.1		75.9
Weeds (unidentified)	82	3.0	100	24.5	85	12.1	80	7.8
Everlasting (Antennaria)	24	2.9	--	--	48	6.3	30	1.0
Pasque flower (Pulsatilla ludoviciana)	6	2.6	12	1.1	--	--	--	--
Water hyssop (Bacopa rotundifolia)	12	0.1	--	--	4	1.1	--	--
Horsetail (Equisetum)	6	tr.	--	--	--	--	--	--
White clover (Trifolium repens)	--	--	12	tr.	30	3.1	20	1.4
Sweet clover (Meliotus)	--	--	--	--	6	1.2	5	0.8
Aspargus (Asparagus officinalis)	--	--	--	--	2	0.6	--	--
Alfalfa (Medicago)	--	--	--	--	2	0.4	--	--
Bedstraw (Galium)	--	--	12	0.4	6	0.2	--	--
Lupine (Lupinus)	--	--	--	--	9	0.1	10	tr.
Yarrow (Achillia lanulosa)	--	--	--	--	4	tr.	5	tr.
Stonecrop (Sedum stenopetalum)	--	--	--	--	2	tr.	10	tr.
Sunflower (Helianthus)	--	--	--	--	2	tr.	5	tr.
American columbo (Frasera speciosa)	--	--	--	--	--	--	10	3.0
Carrion flower (Smilax lasioneuron)	--	--	--	--	--	--	5	0.3
Chickweed (Cerastium)	--	--	--	--	2	tr.	--	--
Anemone (Anemone)	--	--	--	--	2	tr.	--	--
Loco (Oxytropis)	--	--	12	0.2	--	--	--	--

(continued)

TABLE IX

STOMACH CONTENTS OF 99 BLACK HILLS DEER

(PERCENTAGES)

Plant Species	Whitetail Deer						Mule Deer	
	Jan.-Apr.		May-Sept.		Oct.-Dec.		Oct.-Dec.	
	17 Deer		8 Deer		54 Deer		20 Deer	
	Frequency a/	Volume b/	Frequency	Volume	Frequency	Volume	Frequency	Volume
Wild strawberry (Fragaria)	--	--	12	0.2	--	--	--	--
Total Weeds		8.6		26.4		25.1		14.3
Grass (unidentified; mostly Poa)	76	7.0	88	12.0	76	3.3	75	6.2
Wheat (Agropyron triticum)	18	5.6	--	--	2	0.6	--	--
Oats (Avena sativa)	6	0.1	12	1.9	13	3.8	--	--
Corn (Zea mays)	6	0.1	--	--	6	2.3	--	--
Barley (Hordeum vulgare)	--	--	--	--	7	0.6	--	--
Total Grasses		12.8		13.9		10.6		6.2
Old-man's-beard (Usnea)	24	2.9	--	--	31	1.1	35	1.6
Fungi (unidentified)	--	--	62	4.0	31	2.1	25	2.0
Total Fungi and Lichens		2.9		4.0		3.2		3.6

a/ Frequency = percentage occurrence among the stomachs studied in each period.

b/ Volume = in per cent of stomach contents.

Table X

AVAILABLE BROWSE SPECIES ON THE SAMPLE AREA

DURING PERIOD OF STUDY

Scientific Name	Comman Name
Acer glabrum (Torr)	Mountain maple
Amelanchier alnifolia (Nutt)	Serviceberry
Arctostaphylos uva-ursi (L) Spreng	Bearberry or Kinnikinnick
Berberis repens (Lindl)	Creeping hollygrape
Ceanothus velutinus (Dougl)	Snowbrush
Physocarpus malvaceous (Torr) A. Nels	Ninebark
Prunus demissa (Nutt) Walp	Chokecherry
Salix spp.	Willow
Sambucus melanocarpa (Gray)	Elderberry
Symphoricarpos albus (L) Blake	Snowberry
Rosa spp.	Wild Rose
Populus spp.	Poplar
Pseudotsuga taxifolia	Douglas fir
Pinus ponderosa	Ponderosa pine